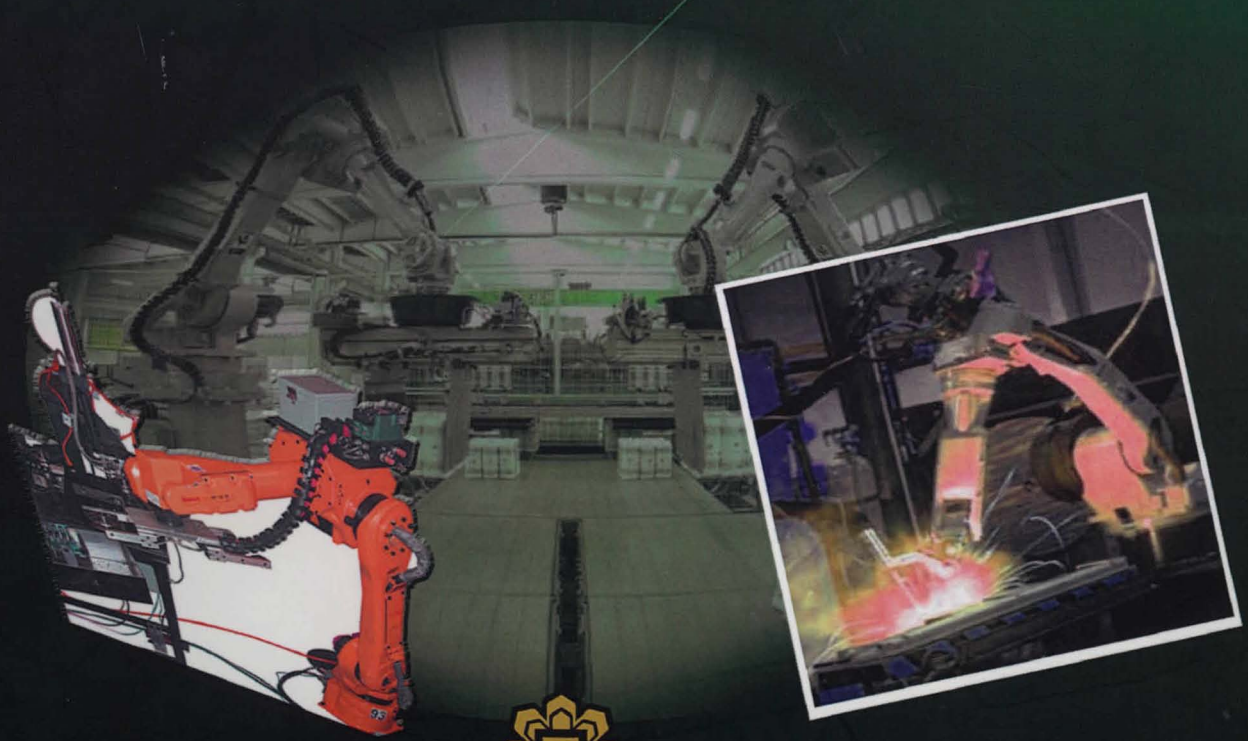
MECHATRONICS BOOK SERIES

ROBOTICS AND AUTOMATION

Rini Akmeliawati
Wahju Sediono
Nahrul Khair Alang Md. Rashid



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CHAPTER 31

Development of an Intelligent Controller for Tropical Food Storage System

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31.1. Introduction

31.1.1 Background

The traditional methods of food storage employed in the western region of Africa often result in heavy losses of edible food. The reason can be adduced to the open nature of the food storage units which are prone to environmental influences. One way to ensure a nations food security is to encourage proper and adequate storage of harvested products. Other advantages of proper food storage are availability of the products outside their seasons which often lead to relatively stable market prices.

Physiological processes occurring within the body of freshly harvested food products often result in the release of heat, moisture, carbon-dioxide and ethylene gases. To prolong the shelf life of harvested food products, there is a need to properly evacuate the mentioned by-products from the storage environment.

While the traditional methods of food storage practiced in West Africa results in heavy losses, other parts of the world especially the developed ones, employ more efficient methods such as the model- and intelligent–based control methods. These methods employ automatic means for storing food products.

31.1.2 Problems associated with the food storage process

The food storage process consists of conditioning air and passing it through a column of the products in the storage unit. Employing automatic control of the process reduces the operational cost of the process. Depending on the product under storage, the air is conditioned for a certain temperature and relative humidity level. During the storage process, the air flowing thru the product pile loses its heat and moisture receiving capacities, thus resulting in the formation of a temperature and moisture gradient within the storage volume. These gradients often result in differential cooling and drying within the same storage unit thus resulting in loss in product quality and quantity especially at the downstream of the storage unit. Another common problem in the storage process involves the formation of hot zones probably due to trapped air in some zones within the storage unit. Drying of the stored products is another problem encountered in the storage process. This problem can possibly be due to flow fluctuations occurring at the entry point and as a result of the turbulent nature of the airflow (Xu and Burfoot, 1999).

31.1.3 Objectives of the study

The main objective is to develop an intelligent controller to control the storage process for tropical postharvest products.

Specific objectives include amongst others:

- the development of a mathematical model for predicting storage parameters such as airflow, temperatures, and relative humidity and the weight loss of products under storage.
- the design and fabrication of an n–compartment prototype storage unit and a 4-compartment storage unit for tropical postharvest products.